FORUM

Case for investing in early childhood

BY M. OLIVIA LAGINA

I believe it is crucial for our society to provide for the developmental needs of our children. What happens in early childhood is the foundation for everything that follows. It has been conclusively demonstrated that brain development is determined in the first 1,000 days of life. By age 5, as much as 90 percent of a child's intellectual and emotional brain wiring has been set. In effect, a child has until 5 to acquire the learning and social skills necessary for a productive future.

It is not complex teaching that is required. A child simply needs a lot of human interaction — hugging, singing, playing, and being read and talked to by parents and adult caregivers.

We all know that Michigan needs to have the most intelligent and best trained work force to compete in the global economy. We only can obtain this goal if we nurture our very young children appropriately.

But right now, Michigan's youngest residents are falling behind. One third of our infants and toddlers is not fully immunized. An estimated 40,000 4-year-olds qualify for, but do not receive, publicly subsidized preschool. A survey of kindergarten teachers found that, on average, 35 percent of the 150,000 Michigan children entering kindergarten each year are not ready to learn. The teachers cite a lack of opportunity to attend a preschool program as a primary factor in these children being behind their peers.

Lagina

This is not just an emotional appeal. I see investment in early-childhood as investment in economic development.

"Dollars invested in early childhood development yield extraordinary public returns," according to two highly-regarded economists at the Federal Reserve Bank of Minneapolis.

For every $1 invested in high-quality early care and education, we can save $17 in welfare, criminal justice and other social costs. Michigan saved an estimated $1.1 billion last year alone because of school readiness efforts since 1984.

More than $200 million of the K-12 budget is spent because grades are repeated and special education must be extended to preventable learning disabilities. Eleven percent of Michigan kindergartners repeat this grade at a cost of $100 million a year. Another $200 million is spent on juvenile corrections that can be traced to inadequate care and education before kindergarten.

These are concrete examples of the state incurring costs — borne by taxpayers — that are unnecessary.

A business case also can be made for strategic reform. A high-level consolidated state office of early childhood could result in more efficient and accountable delivery of early-childhood health and education services.

We have a tremendous opportunity in 2011 to elevate the business case for early-childhood investment to a higher level of statewide priority. A new governor and new Legislature can score an early and crucial win by doing so.

As business leaders we must look to the bottom line for Michigan and the future of our economy. We know that investing in early childhood pays off.

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The importance of relative standards in ADHD diagnoses: Evidence based on exact birth dates☆

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ABSTRACT

This paper presents evidence that diagnoses of attention-deficit/hyperactivity disorder (ADHD) are driven largely by subjective comparisons across children in the same grade in school. Roughly 8.4 percent of children born in the month prior to their state's cutoff date for kindergarten eligibility – who typically become the youngest and most developmentally immature children within a grade – are diagnosed with ADHD, compared to 5.1 percent of children born in the month immediately afterward. A child's birth date relative to the eligibility cutoff also strongly influences teachers' assessments of whether the child exhibits ADHD symptoms but is only weakly associated with similarly measured parental assessments, suggesting that many diagnoses may be driven by teachers' perceptions of poor behavior among the youngest children in a classroom. These perceptions have long-lasting consequences: the youngest children in fifth and eighth grades are nearly twice as likely as their older classmates to regularly use stimulants prescribed to treat ADHD.

1. Introduction

Attention-deficit/hyperactivity disorder (ADHD) is the most commonly diagnosed behavioral disorder among children, with diagnosis rates ranging from 8 to 12 percent in OECD countries (Biederman and Faraone, 2006). Fueled largely by increasing recognition of ADHD as a legitimate disorder within the medical community, prescriptions of psychostimulants to children diagnosed with ADHD rose by more than 700 percent in the U.S. between 1991 and 2005 (Mayes and Erkulwater, 2008). In 2006, the Centers for Disease Control and Prevention estimated that 4.5 million children under age 18 were diagnosed with ADHD, with roughly 2.5 million of these children regularly using prescription medication to treat their symptoms (Bloom and Cohen, 2007).

Despite the rapid growth in ADHD diagnoses, treatment, and related expenditures, researchers and practitioners disagree about the disorder's underlying incidence—published estimates vary from less than 2 percent to nearly 17 percent. This lack of consensus has contributed to intense public debate about whether ADHD is over- or under-diagnosed in American children. The dramatic increase in the use of prescription stimulants intended to treat ADHD has also spawned widespread concern that millions of children regularly use potentially harmful medications to treat a disorder with inherently subjective symptoms (LeFever et al., 2003).

In this paper, we investigate the role that subjective comparisons across children play in ADHD diagnoses by assessing whether children who are young relative to their classmates in school are disproportionately diagnosed with and eventually treated for ADHD. We also analyze the relationship between a child's age relative to his classmates and both teacher- and parent-reported assessments of ADHD symptoms. Under the assumption that the underlying chemical and neurological incidence of ADHD does not vary by a child's date of birth, evidence of an effect of a child's age-for-grade on measures of ADHD would imply that within-grade

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comparisons across children play a significant role in the perception of symptoms and eventual diagnoses.

We analyze data from the Early Childhood Longitudinal Study-Kindergarten cohort (ECLS-K), which is uniquely suited to studying ADHD because it includes parent and teacher reports of ADHD symptoms, diagnoses, and stimulant-based treatments. We study the relationship between a child's age-for-grade and these measures of ADHD by focusing on discontinuities in school starting age between children born just before and just after statewide kindergarten eligibility cutoff dates, which determine whether a child is eligible to enroll in kindergarten in a given school year.[1] For example, a child born in October may begin kindergarten the year he turns five if he lives in a state with a cutoff of December 1, but the same child would have to delay kindergarten enrollment until the following year if he lived in a state with a cutoff of September 1 (the most common cutoff date, applying in 15 states in 2010).

Our analyses produce three substantive findings. First, ADHD diagnoses among children born just prior to their state's kindergarten eligibility cutoff are more than 60 percent more prevalent than among those born immediately afterward. This discontinuity implies that the ADHD diagnosis rate among the youngest children in a classroom is 5.4 percentage points higher than it would have been if those children had instead waited an additional year to begin kindergarten. Given that the baseline ECLS-K diagnosis rate is 6.4 percent, this estimate represents a substantial effect. Second, the youngest kindergarten entrants are significantly more likely than their older classmates to use behavior-modifying prescription stimulants in grades 5 and 8. The influence of school starting age on stimulant usage is particularly pronounced for methylphenidate, commonly known by the brand name Ritalin: children born just before a cutoff are more than twice as likely to regularly use methylphenidate as those born immediately afterward. If these patterns are driven entirely by inappropriate diagnoses and treatment among the youngest children in a grade, our estimates imply that roughly 20 percent of the 2.5 million children who use stimulants intended to treat ADHD have been misdiagnosed. Such inappropriate treatment is particularly worrisome because of the unknown impacts of long-term stimulant usage on children's health. Although no studies have directly measured long-term health outcomes among those treated for ADHD, chronic use of ADHD stimulants causes persistent cardiovascular changes (namely, increases in blood pressure and resting pulse rates) that are known to be strongly associated with morbidity and mortality among adults (Nissen, 2006).

Finally, a child's school starting age strongly affects teachers' perceptions of whether the child exhibits ADHD-related symptoms but only weakly influences similarly measured parental perceptions. Discontinuities around eligibility cutoffs in teacher reports of hyperactivity and inattentiveness are four times larger than the corresponding discontinuities based on parent reports. These patterns suggest that teachers' opinions of children are the key mechanisms driving the relationship between school starting age and ADHD diagnoses. Current National Institute of Mental Health (NIMH) guidelines for diagnosis explicitly instruct health professionals to consider whether a child exhibits attention deficits and hyperactivity relative to his or her peers, but these relative assessments are presumably intended to compare children of the same ages, rather than children of different ages within the same grade (NIMH, 2008). Our results are consistent with teachers using within-grade comparisons across students to assess whether a child has ADHD symptoms, but these "symptoms" may merely reflect emotional or intellectual immaturity among the youngest children in a classroom.[2]

2. Background and literature review

In 1999, the U.S. Surgeon General reported that roughly 20 percent of American children exhibited signs of emotional or behavioral disorders (U.S. Department of Health and Human Services, 1999). As the incidence and importance of behavioral disorders such as ADHD has come to light, researchers in a variety of disciplines have sought to assess the effects of these disorders on children's outcomes. In particular, studies of the effects of ADHD have consistently found strong negative correlations between ADHD diagnoses and outcomes in childhood and adolescence. However, these relationships may stem from unobservable factors that influence both ADHD diagnoses and outcomes, such as the presence of other mental or emotional problems.[3]

Currie and Stabile (2006, 2009) address a potential source of bias in estimates of the effects of ADHD by estimating models that include sibling fixed effects, which capture family-level unobserved correlates of both ADHD and outcomes. Using the NLSY and the Canadian National Longitudinal Study of Children and Youth, they show that children exhibiting high levels of ADHD symptoms at early ages performed poorly on future cognitive tests and were disproportionately likely to repeat a grade in school. These effects are essentially insensitive to the inclusion of the sibling fixed effects, suggesting that unobserved family-level heterogeneity does not drive the relationship between ADHD and child outcomes. Similarly, Fletcher and Wolfe (2008) use data from the NLSY and Add Health to examine the effects of ADHD symptoms on long-run outcomes such as educational attainment. Fletcher and Wolfe find that ADHD symptoms are negatively associated with these long-run outcomes but that some of the estimated effects disappear in models that include sibling fixed effects. These authors also show that a child's ADHD symptoms are negatively related to his siblings' outcomes, perhaps because of compensating behavior of parents.

A particular strength of the Currie and Stabile (2006, 2009) and Fletcher and Wolfe (2008) studies lies in their focus on parent- and teacher-reported ADHD symptom levels instead of diagnoses. Their measures of ADHD thus do not depend on whether a child was ever evaluated by a medical professional, which may be correlated with parental engagement, income, or other determinants of outcomes. Furthermore, a diagnosis of ADHD requires evidence of symptoms in two or more settings, such as at home and at school, highlighting the role of the school environment in the detection and diagnosis of ADHD. As a result, the binary measures of ADHD diagnoses studied by authors such as Mannuzza and Klein (2000)

[1] Authors such as Bedard and Dhuey (2006), Cascio (2009), Cascio and Lewis (2006), Datar (2006), Elder and Lubotsky (2009), Fertig and Kluve (2005), Fredriksson and Öckert (2005), McCrary and Royer (2006), and McEwan and Shapiro (2008) have used identification strategies based on eligibility cutoffs to estimate the effect of a child's school starting age on a number of outcomes, including test scores, grade repetition, educational attainment and earnings.

[2] Some degree of subjectivity in ADHD diagnoses may be unavoidable because its primary symptoms, inattentiveness and hyperactivity, are apparent in nearly all children, especially those under the age of six (National Collaborating Centre for Mental Health, 2009). A positive diagnosis requires that these symptoms cause "significant impairment" due to their frequency or severity, and a judgment of what constitutes "significant impairment" may be inherently subjective.

[3] Mannuzza and Klein (2000) summarize several longitudinal studies of the effects of ADHD symptoms on long-run outcomes. These studies consistently show that children diagnosed with ADHD have worse outcomes into adolescence than those not diagnosed with ADHD, with especially large differences in educational attainment and measures of mental health, but all of the studies are limited in their ability to control for confounding factors associated with both ADHD diagnoses and outcomes.

also capture characteristics of schools that may directly affect student outcomes. All of these studies focus on either symptoms or diagnoses, but not both, because of data limitation issues—until the release of the ECLS-K, no nationally representative data source included measures of both ADHD-related symptoms and diagnoses. We turn next to describing these ECLS-K data in more detail.

3. Data and descriptive findings

The ECLS-K is a National Center for Education Statistics (NCES) longitudinal survey that initially included 18,644 kindergarteners from over 1000 kindergarten programs in the fall of the 1998–1999 school year. Individuals were re-sampled in the spring of 1999, the fall and spring of the 1999–2000 school year (when most of the students were in first grade), and again in the spring of 2002, 2004, and 2007 (when most were in third, fifth, and eighth grade, respectively). NCES also interviewed parents and teachers in each survey wave.

We match each child in the ECLS-K to the state-mandated kindergarten eligibility cutoff that applied in the child's state of residence in 1998.[4] 14,333 children with valid information on state of residence appear in the initial survey and at least one other interview. Excluding children living in states without statewide cutoff results in a sample of 11,784 children. Table A.1 lists the cutoff laws in place in all states and the District of Columbia in 1998.

As noted above, the ECLS-K is particularly useful for studying ADHD because it includes binary measures of ADHD diagnoses and treatment as well as teacher and parent reports of ADHD-related symptoms. Reported ADHD symptom levels provide different (and arguably better, as emphasized by Currie and Stabile, 2006) information than indicators of diagnosis, but each of these measures plays an important role in the analyses below.

3.1. Binary indicators of ADHD diagnoses and medication usage

In all waves of the ECLS-K, restricted-use data files include parental reports of whether a child has been diagnosed with a learning problem such as ADHD, autism, dyslexia, developmental delays, or learning disabilities. We create a binary indicator equal to one if a child was ever diagnosed with ADHD as of the spring 2007 survey and zero otherwise (Appendix A provides detailed information about the creation of this variable). Additionally, in the spring of 2004 and 2007, parents who reported in any survey that their child had been diagnosed with ADHD or related disorders were asked a follow-up question about the usage of prescription medication intended to treat them:

> "In an earlier year of the study, someone in your household told us that {CHILD} has attention deficit disorder, ADHD, or hyperactivity. Is {CHILD} now taking any prescription medicine for the condition related to {HIS/HER} ADD, ADHD, or hyperactivity?"

Parents who answered affirmatively were then asked an open-ended question about which medication their child was currently taking. Responses included methylphenidate, sold under the brand names Ritalin, Metadate, and Concerta, and amphetamine-based drugs such as Adderall and Dexedrine. We create two indicator variables based on these questions: the first equals one if a child uses any prescription medication in either 2004 or 2007 and zero otherwise, and the second equals one if the child specifically uses methylphenidate and zero otherwise.[5]

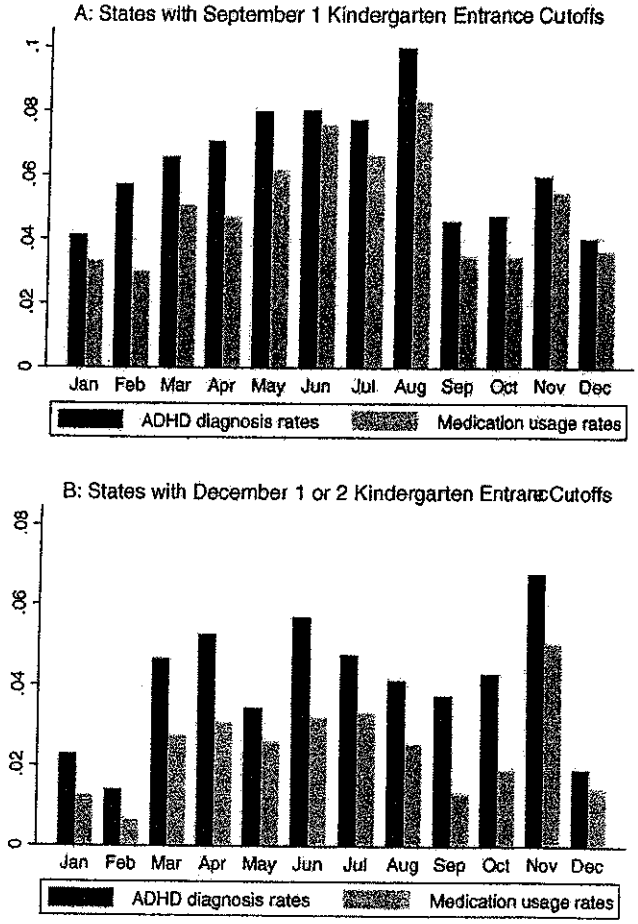

Fig. 1. Rates of ADHD diagnosis and behavioral medication usage by birth month, ECLS-K. (A) States with September 1 kindergarten entrance cutoffs; (B) states with December 1 or 2 kindergarten entrance cutoffs.

Fig. 1 presents graphical evidence of the relationship between ADHD diagnoses and a child's month of birth. The darkly shaded bars in Panel A show average ADHD diagnosis rates by birth month in the 15 states with September 1 cutoff dates. The results are striking: diagnosis rates rise steadily with birth month from January to August but then fall sharply between August and September. 10.0 percent of children born in August are diagnosed with ADHD, more than twice the 4.5 percent diagnosis rate among those born in September. These rates are statistically distinguishable at conventional significance levels ($t = 3.10$). The lightly shaded bars in the figure show the corresponding fractions of children who regularly use prescription stimulants to control ADHD symptoms. The monthly averages track diagnosis rates closely, and children born in August are more than twice as likely to use stimulants as those born in September (8.3 percent versus 3.5 percent; $t = 2.47$). These sizeable differences in diagnosis and medication rates between the youngest (born in August) and oldest (born in

[4] State of residence in the ECLS is listed in the base year ECLS-K restricted-use "Geocoded Location" files (procedures for applying for NCES restricted-use data are explained on the ECLS-K website: http://nces.ed.gov/ecls/Kindergarten.asp). State kindergarten cutoffs were matched to ECLS-K respondents and obtained from individual state statutes as well as from the Education Commission of the States.

[5] We create a measure focused on methylphenidate in particular because it is almost exclusively prescribed to treat ADHD. In contrast, amphetamines, the other treatments typically prescribed for ADHD, are also frequently used to treat depression, epilepsy, narcolepsy, and other disorders (National Collaborating Centre for Mental Health, 2009).

September) children in a grade suggest that the youngest children may be over-diagnosed (and over-medicated), the oldest children are under-diagnosed, or both.[6]

Panel B of the figure presents analogous findings for states with December 1 or 2 kindergarten entrance cutoffs. In these states, the biggest month-to-month change now appears between November and December. The ADHD diagnosis rate among children born in November is 6.8 percent, more than triple the 1.9 percent rate among those born in December. The corresponding rates of stimulant usage are 5.0 and 1.5 percent, respectively. Only 4.1 percent of children born in August in these states are diagnosed with ADHD, compared to 10.0 percent of August-born children living in the September 1 cutoff states. This 5.9 percentage-point difference is surprising because both samples of August-born children start school at approximately the same age; the average age school starting age among August-born children is 5.17 in the September 1 cutoff states and 5.09 in the December 1 and 2 cutoff states. The discrepancy in diagnoses may partly be driven by more aggressive diagnostic practices in the September 1 cutoff states, which have 2.3 percentage-point higher overall diagnosis rates than do the December 1 and 2 cutoff states. Under the assumption that these cross-state differences account for 2.3 percentage-point higher diagnosis rates in every month, a 3.6 (=5.9–2.3) percentage-point differential remains, which is significantly different from zero ($t=2.09$). This pattern suggests that what matters for ADHD diagnoses and treatment is not merely that these children are young when they enter kindergarten, but that they are young *relative* to their classmates. Put differently, many August-born children diagnosed with ADHD and living in states with September 1 cutoffs may have never been diagnosed had they simply lived in a state with a December cutoff.[7]

3.2. ADHD-related symptoms based on teacher and parent reports

Teachers in the first, second, and fourth waves of the ECLS-K rate individual students on scales from 1 ("never") to 4 ("very often") on 24 different dimensions intended to measure social, emotional, and cognitive development. NCES does not release data on each of these 24 items individually, instead aggregating them to five composite scales known as Social Rating Scales (SRS).[8] The first, the "approaches to learning" scale, includes six items that rate a child's attentiveness, task persistence, eagerness to learn, learning independence, flexibility, and organization. Similarly, the "self-control" scale includes four items that measure a child's ability to control his behavior, and the "interpersonal skills" scale includes five items that measure a child's ability to interact with others. For all three of these scales, higher scores are associated with higher levels of development. The fourth scale, "externalizing problem behaviors", includes five items that rate the frequency with which a child acts impulsively, interrupts ongoing activities, fights with other children, gets angry, and argues. Finally, the "internalizing problem behaviors" scale includes four items that rate the presence of anxiety, sadness, loneliness, and low self-esteem. In these latter two scales, higher scores are associated with worse social development. All five of the composite scales are measured as averages of the underlying items and therefore have a range of possible values from 1 to 4.

A diagnosis of ADHD requires evidence of at least six symptoms of inattention or at least six symptoms of hyperactivity, with these symptoms persisting for six or more months before the age of seven (as noted above, these symptoms much be present in at least two settings). Appendix A lists the specific criteria for ADHD diagnosis, given in the American Psychiatric Association's Diagnostic and Statistical Manual-IV, Text Revision (DSM-IV-TR; American Psychiatric Association, 2000), and provides more details about the SRS composites. The "approaches to learning" and "externalizing problem behaviors" scales overlap with DSM-IV-TR criteria most closely, with the former measuring several aspects of attentiveness and the latter measuring behaviors related to hyperactivity and impulsiveness, and we present evidence below that all five SRS composites are correlated with actual ADHD diagnoses.

Parents of ECLS-K children also provide SRS assessments, although some of the scales are modified to reflect children's behavior in the home rather than at school. The "approaches to learning" and "self-control" scales are identical to those completed by teachers, but instead of an "interpersonal skills" scale, parents complete a "social interaction" scale intended to measure similar concepts. Parents also complete "impulsive/overactive" and "sad/lonely" scales which are similar to the "externalizing problem behaviors" and "internalizing problem behaviors" scales, respectively; for example, three of the four items on the "sad/lonely" and "internalizing problem behaviors" scales are identical. Again, Appendix A provides more details on the coding and construction of these scales, as well as information on all other variables used in the analyses below.

3.3. Descriptive statistics

Table 1 presents descriptive statistics in the base ECLS-K sample of 11,784 children. The column labeled "Full Sample" lists overall sample means of each of the listed variables and also includes standard deviations of non-binary variables. The top rows in the table show that 6.4 percent of all children are diagnosed with ADHD by spring 2007 (when most are in eighth grade), 4.5 percent regularly use behavior-modifying stimulants, and 3.1 percent use methylphenidate in particular. The next two columns consider children born fewer than 181 days before their state's eligibility cutoff and fewer than 181 days after the cutoff, respectively, essentially dividing a year into two halves. Those born before the cutoff dates are roughly 50 percent more likely to be diagnosed with ADHD (0.075 versus 0.051) and to use behavioral medications in grade five (0.054 versus 0.035) than those born after cutoff dates. The latter group is also nearly half a year older when they enter kindergarten, on average (5.618 versus 5.197).

The table also shows the relationship between a child's date of birth relative to the cutoff dates and the fall 1998 teacher and parent SRS composites. For the first three teacher composites, "approaches to learning", "self-control", and "interpersonal skills", the means in the third column are all significantly higher

[6] Not all children enter kindergarten as soon as they are legally eligible, and the fraction of children who voluntarily delays kindergarten is especially high in birth months just before eligibility cutoff dates. Elder and Lubotsky (2009) find that nearly 30 percent of those born less than one month before a cutoff date wait an additional year to enter kindergarten in ECLS-K. Nonetheless, the average school starting age of those born just before eligibility cutoffs is roughly 0.66 years lower than those born just afterward.

[7] Patterns of ADHD diagnoses and treatment in the neighborhood of other cutoff dates generate similar inferences as those based on Fig. 1. For example, ADHD diagnosis rates among children born in December in states with December 31 or January 1 cutoffs are roughly 60 percent higher than among children born in January in the same states (17.4 percent versus 10.9 percent). In a combined sample of the seven states with December or January cutoffs, the overall and August-born diagnosis rates are both 5.1 percent, while the overall and August-born diagnosis rates among those in the states with September 1 cutoffs are 6.4 percent and 10.0 percent, respectively.

[8] The Social Rating Scales used by NCES are adaptations of the scales designed by Gresham and Elliott (1990). Because the scales are copyright-protected, their precise wording cannot be reproduced here; we refer interested readers to Gresham and Elliott (1990).

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Delaying Kindergarten

Effects on Test Scores and Childcare Costs

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Abstract

Is it beneficial to delay the age at which children begin kindergarten? New research finds that kids who enter at age 6 instead of age 5—especially kids from disadvantaged families—do significantly better on standardized tests and learn more from schooling. But delaying entry also leads to substantial additional childcare costs—especially for poor families. These findings argue that policymakers may need to view entrance age policies as a package—one that considers both cognitive and noncognitive consequences.

Driven by the results of a series of studies showing that older entrants to kindergarten perform better than younger ones, there has been a nationwide trend among states toward raising the minimum entrance age for kindergarten.

But how convincing are such studies? For one thing, the results are not causal because the studies fail to account for the fact that parents, in part, choose when their child starts kindergarten based on a host of observable and unobservable factors that may also affect their child's school outcome, an issue that can bias estimates of the entrance age effect. Moreover, the studies relied on small and unrepresentative samples to estimate the effect. And even if the performance effect is real, does it persist beyond kindergarten?

If there is no real entrance age effect (or if such an effect does exist but does not persist), then delaying children's entrance into school may deprive many children who are "ready" of the benefits of schooling. Delays could be especially significant for disadvantaged children, who, if not enrolled in school, may be unable to attend a high-quality preschool or day care instead.

And cognitive effects are not the only effects. Even if there is a persistent cognitive effect, postponing school can place a significant economic burden on families, forcing them to bear an extra year of either the monetary or time costs of childcare.

A study by RAND Corporation researcher Ashlesha Datar addresses these concerns. It uses a nationally representative sample of kindergartners from the Early Childhood Longitudinal Study and instrumental variables—e.g., the child's birth date relative to the school's entry cutoff date—so estimates of the entrance age effect can be interpreted as causal.

The research asks (1) whether older entrants achieve higher test scores compared to younger ones at the beginning of kindergarten; (2) whether older entrants gain more or less over time from schooling than younger ones; (3) whether at-risk children, such as the poor, benefit more than others from delaying kindergarten; and (4) what effect entrance-age policy changes have on families' childcare costs.

Entering Kindergarten Later Significantly Boosts Test Scores at Entry

To understand the cognitive effects of entering kindergarten later, Datar looked at academic achievement as measured by math and reading test scores on standardized tests. The results indicate that delaying kindergarten entrance is associated with a significant increase in math and reading scores at kindergarten entry. A one-year delay in kindergarten entrance increases math and reading scores by 6 points and more than 5 points, respectively. Also, the findings suggest that previous studies that failed to account for the selection bias underestimate the effect of delaying kindergarten age.

Benefits Do Not Fade and Are Even Greater for Disadvantaged Children

As noted earlier, there is concern that any positive benefits may not persist and that forcing disadvantaged children to wait a year may thus be counterproductive. However, as the figure below shows, these concerns seem unfounded.